EEPROM AGENT RECORD

BACKGROUND OF THE INVENTION

The invention relates to an Eeprom agent record.

An electronic device as usually used in many modern electronic based apparatuses like a computer device is generally operated by an electronic operating system. For its function the electronic device needs power. When switching on the power for the electronic device, usually the operating system has to be booted up in a boot-up process. Usually the basic information about the electronic device and the operating system is saved in a non-volatile read only memory, which was manufactured corresponding to the required demands. During the boot-up process the registers of the electronic device are initiated.

Common read only memories in modern electronic based apparatuses are realized by semiconductor memory devices. Each semiconductor memory device comprises several memory units, which are arranged in at least one memory matrix. The memory units comprise semiconductor components, which are built invariably into the memory matrix corresponding to the hardwired programming of the read only memory. The semiconductor components are located on semiconductor chips and can be manufactured with generally known semiconductor fabrication techniques. One of the main semiconductor fabrication techniques is lithography. During different lithographic processes the semiconductor components are formed by means of masks corresponding to the information, which has to be saved in the read only memory.

An electronic device with a read only memory has some disadvantages. The most disadvantages refer to the costly production of the read only memory. Therefore, the production of read only memory has to be performed very exactly. If an error or failure occurs during planning or producing the read only memory, the whole production

process has to be stopped, new masks have to be made and a new production series has to be started. The faulty read only memories are useless and have to be scrapped.

A similar problem occurs, if the electronic device is updated and therefore the information in the read only memory has to be changed. Then, the current read only memory has to be scrapped and replaced by a newly produced read only memory according to the updated electronic device.

SUMMARY OF THE INVENTION

One main aspect of the invention is to provide a possibility to initiate an action prescribed by an agent record by an agent code saved in a read only memory without the need of a costly remasking and newly producing of the read only memory for, e.g., a correction of register values inside a processing device. An agent code according to this document is mainly a piece of code, which will be embedded in a boot-up process in anticipation for a need to change the boot-up process. The boot-up process can be changed according to information comprised in the agent record. In the boot-up process, for instance, a register value or register settings may be changed, or further code may be executed or corrected.

A method, a boot-up process and an electronic device according to the independent claims of the invention enable a correction of register values inside a processing device according to an agent record saved in an erasable and programmable memory device.

A method for executing an agent code, wherein the agent code is saved in a read only memory, wherein an agent record containing data is saved in an erasable and programmable memory device, and wherein the method comprises the following steps: reading the agent code from the read only memory and loading it into a processing device, executing the agent code, thereby initiating reading the agent record from the erasable and programmable memory device and loading it into the processing device, and executing the agent record in the processing device.

A boot-up process for booting up a processing device, wherein an agent code is saved in a read only memory, wherein the agent code contains a first agent record identification code, wherein a plurality of agent records each containing a second agent record identification code, a register identification code and data is saved in an erasable and programmable memory device, and wherein the boot-up process comprises the following steps: initializing a plurality of registers in the processing device, reading and executing the agent code, thereby reading the plurality of agent records and checking as to whether a match between a second agent record identification code and the first agent record identification code exists and, for the case that a match is found to exist, assigning the data of the matching agent record to a specified register according to the register identification code of the matching agent record.

An electronic device for executing agent code comprising a read only memory, an erasable and programmable memory device, and a processing device, wherein the agent code is saved in the read only memory and an agent record containing data is saved in the erasable and programmable memory device, the processing device being designed such that it can perform the following steps: reading the agent code from the read only memory and loading it into a processing device, executing the agent code, thereby initiating reading the agent record from the erasable and programmable memory device and loading it into the processing device, and executing the agent record in the processing device.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows an electronic device 100 according to a preferred embodiment of the invention; and

Figure 2 shows a message flow diagram 200 of the electronic device 100 according to the preferred embodiment of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT OF THE INVENTION

A preferred embodiment of the invention will now be described with reference to the attached drawings in which like parts or elements are denoted by like reference numbers.

Figure 1 shows an electronic device 100 according to a preferred embodiment of the invention. The electronic device 100 includes a processing device (PD) 101, a read only memory (ROM) 102 and an erasable and programmable memory device (EPMD) 103, according to this embodiment an EEPROM (**E**lectrical **E**rasable **P**rogrammable **R**ead **O**nly **M**emory). The read only memory 102 and the erasable and programmable memory device 103 are electronically connected with the processing device 101.

During the boot-up process of the processing device 101 the registers of the processing device 101 are initialized, that is, given values are assigned to the registers. The registers of the processing device can be parts of the central processing unit (CPU), of application specific integrated circuits (ASIC) or of synchronous dynamic random access memories (SDRAM). Further, an agent code is executed by the boot-up process to provide an opportunity to fix problems, if any, or to perform extra functions during the boot-up process. The agent code is saved in the read only memory 102. In the erasable and programmable memory device 103 an agent record is saved, which is necessary for correcting register values. The agent record includes an agent record identification code, an agent record length, and data. The agent record length is an information about the size of the data. And the data prescribes an action to be taken. The data can be instructions, or values to be reassigned to, for example, registers.

An example of correcting register values during the boot-up process is first provided. In that case, the data of the agent record includes two parts: a register identification code and content. The register identification code gives an information about which register the content belongs to, and can be an address offset. The content includes vaues to be written to the register identified by the register identification code.

After switching-on the power for the processing device 101 a boot-up process starts processing in the processing device 101. The processing device 101 includes preferably a random access memory (RAM). During the boot-up process the N registers 102 of the processing device 101, for example the CPU registers and ASIC registers, are initialized. This means, that given values are assigned to some or all of these registers 102. Then, the boot-up process executes the command to read the agent code from the read only memory 103 and to load it into the random access memory. The agent code includes a specific agent record identification code (ID). Further, the agent code as part of the boot-up process reads a specific agent record with a matching agent record identification code from the erasable and programmable memory device 104 and to load it into the random access memory. Now the agent record is executed in the processing device 101 by the boot-up process. According to the register identification code of the agent record, which indicates a specific register 102, the data being part of the agent record are assigned to the specific register 102 predetermined by the register identification code. This becomes more clear in consideration with Figure 2.

An exemplary agent code written in BASIC fro performing the function described above is hereto enclosed:

```
Sub agentcode1()

Dim Agent_id As Byte

Dim Agent_recodesize As Byte

Dim Offset As Byte 'the offset from the base address of EEPROM where the agent ID is located

Dim EEPROM(256) As Byte

Dim asicregisters(256) As Integer

Offset = 42

SizeOfEeprom = 256
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EndOfAgentRecords = 255

IdOfThisAgent = 1

While (Offset < SizeOfEeprom)

Agent_id = EEPROM(Offset)

  While (Agent_id <> EndOfAgentRecords)

    If Agent_id = IdOfThisAgent Then

      asicregisters(EEPROM(Offset + 2) * 256 + EEPROM(Offset + 3)) =
EEPROM(Offset + 4) * 256 + EEPROM(Offset + 5)

    Else

      Offset = Offset + EEPROM(Offset + 1) + 1 'calc the new offset to the next
agent record ID

    End If

  Wend

Wend

End Sub
```

Figure 2 shows a message flow diagram 200 of the electronic device 100 according to the preferred embodiment of the invention. First, the boot-up process running in the processing device PD initializes the N registers (REG N) 201, wherein given values are assigned to some or all of the registers REG N. Then, the boot-up process executes the command "read agent code" 202 at the read only memory ROM. Next, the read only memory ROM provides the agent code to the processing device PD, which is loading the agent code 203. Afterwards, the boot-up process executes the agent code 204 and accordingly the command "read agent record" 205 at the erasable and programmable memory device EPMD. If an agent record with an appropriate agent record identification code is saved in the erasable and programmable memory device EPMD, the agent record is provided to the processing device PD, which loads the agent

record 206. Finally, the boot-up process executes the agent record 207, i.e., the data of the agent record 208 are assigned according to the register identification code of the agent record to an identified register REG N.

Another example of agent record is also provided. After re-assigning the register values, the boot-up process is further processed. For example, an phase-locked loop (PLL) initialization routine can be loaded into the random access memory (RAM) of the processing device PD as defined by the boot-up process. Then, a further agent code can be executed to initiate an appropriate agent record for correcting the PLL routine. Afterwards, the PLL routine can be executed and the processing device PD is switched into higher speed.

The content of the erasable and programmable memory device EPMD can have the following illustrative format:

Address (byte):	Size (byte):	Description:
0	2	Device identification code (ID)
2	10	Password
12	10	User name
22	20	Device management data
42	variable	Agent record 1
		Agent record 2
		Agent record 3
		...
256		End of EPMD

Further, the agent record can have the following illustrative format:

Field name:	Size (byte):	Description:
Agent record ID	1	Unique ID that identifies the agent code. The boot-up process checks this field to decide if this agent record belongs to the actually executed agent code.
Size of agent record	1	The size of the following data field.
Agent data	variable (from 1 to 255)	Specific data for this agent code.

The agent data comprise an address offset and the real data. The address offset has to be added to the ASIC base address for receiving the final register identification code. The real data are the values which have to be written to the ASIC register specified by the register identification code. Both, the address offset and the real data, have a field size of two byte according to this embodiment of the invention.

An example of the agent record can be found in the following:

Field name:	Size (byte):	Content:	Description:
Agent record ID	1	0x1	Indicates agent code 1.
Size of agent record	1	0x4	
Agent data	4	0x00121234	An address offset of 12 has to be added to the ASIC base address for receiving the register identification code. The real data to be written to the identified register are 0x1234.